

ALLAMA IQBAL OPEN UNIVERSITY, ISLAMABAD

(Department of Environmental Science)

Course Name:	Introduction to Environmental Science
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Assignment No:	Assignment-1 (Units 1-4)
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Pass Marks:	BS: 50 / BA: 40

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Question 1: Discuss the historical development of environmental awareness in Pakistan. (20)

Answer:

1. Introduction to Environmental Awareness in Pakistan

Environmental awareness in Pakistan has evolved significantly over the past five decades, transitioning from a localized natural resource management framework to a comprehensive national legislative and institutional system. Initially, environmental protection was viewed primarily through the lens of agriculture and forestry. However, growing industrialization, rapid urbanization, and extreme climate vulnerability have catalyzed a broader national movement towards environmental sustainability.

2. Key Historical Milestones and Legislative Evolution

- Pre-1970s Era:** Environmental management was largely informal and fragmented under colonial-era forestry and canal water laws (e.g., Forest Act of 1927). Policy focus remained exclusively on agricultural expansion and timber extraction without systematic ecological impact assessments.
- 1972 Stockholm Conference Impact:** Pakistan's participation in the 1972 UN Conference on the Human Environment in Stockholm marked the initial shift toward formal policy. In 1975, the Environment and Urban Affairs Division (EUAD) was established under the Ministry of Housing and Works.
- 1983 Environmental Protection Ordinance (EPO):** Pakistan's first dedicated federal environmental legislation - the Pakistan Environmental Protection Ordinance of 1983. This ordinance created the Pakistan Environmental Protection Council (PEPC) and established the federal Pakistan Environmental Protection Agency (Pak-EPA).
- National Conservation Strategy (NCS) 1992:** With assistance from IUCN, the NCS was a landmark policy blueprint that integrated environmental preservation into macro-economic planning, identifying 14 core operational areas including soil conservation, water management, and energy efficiency.
- Pakistan Environmental Protection Act (PEPA) 1997:** Repealed the 1983 Ordinance, establishing mandatory Initial Environmental Examinations (IEE) and Environmental Impact Assessments (EIA) for

industrial and infrastructure projects, while introducing National Environmental Quality Standards (NEQS).

- **18th Constitutional Amendment (2010):** Provided an environmental mandate to provincial governments. Each province established its own EPA and enacted provincial Environmental Protection Acts (e.g., Punjab Environmental Protection Act 2012, Sindh EPA 2014).
- **Recent Initiatives & Climate Governance:** The Ministry of Climate Change, the Climate Change Act 2017, and flagship ecological restoration programs like the Ten Billion Tree Tsunami Project (TBTP) and Eco-System Restoration Fund reflect modern mainstreamed environmental policy.

3. Role of Civil Society, NGOs, and Public Awareness

Civil society organizations such as IUCN Pakistan, WWF-Pakistan, and Sustainable Development Policy Institute (SDPI) have played a foundational role in raising public consciousness, advocating for wildlife preservation, and building community-based resource management models across Gilgit-Baltistan and Khyber Pakhtunkhwa.

Question 2: Evaluate the role of environmental education in achieving sustainable development in Pakistan. (20)

Answer:

1. Conceptual Foundation of Environmental Education

Environmental Education (EE) is a interdisciplinary educational approach designed to foster a ecologically literate citizenry equipped with knowledge, values, and practical skills required to address environmental degradation and advance Sustainable Development Goals (SDGs), specifically SDG 4 (Quality Education), SDG 12 (Responsible Consumption), SDG 13 (Climate Action), and SDG 15 (Life on Land).

2. Key Domains of Environmental Education in Pakistan

- **Formal Education System:** Integration of environmental concepts into school curricula (Primary to Higher Secondary) under the Single National Curriculum (SNC). At the university level, specialized BS, MS, and PhD programs in Environmental Sciences have expanded across institutions like AIOU, NUST, and Punjab University.
- **Non-Formal Education & Media:** Awareness campaigns executed via electronic media, social networks, and community workshops highlighting civic waste management, water conservation, and anti-plastic campaigns.
- **Informal & Community Learning:** Farmer field schools (FFS) educating rural communities on integrated pest management (IPM), climate-smart agriculture, and rainwater harvesting techniques.

3. Critical Role in Achieving Sustainable Development

- **Behavioral Transformation:** EE instills resource conservation ethics, mitigating municipal solid waste generation and curbing water wastage in urban centers.
- **Disaster Risk Reduction (DRR):** Educating vulnerable mountain and coastal populations on flash flood warnings, landslide management, and climate adaptation strategies.
- **Promotion of Green Jobs:** Equipping students and engineers with technical skills in renewable energy (solar/wind installation), environmental auditing, and sustainable urban design.

4. Challenges and Strategic Recommendations

Key challenges include textbook-oriented rote learning lacking field-based practical exposure, inadequate teacher training in environmental pedagogy, and rural-urban educational disparities. Strategic recommendations encompass establishing school eco-clubs, mandatory community service in environmental drives, and provincial funding for environmental research hubs.

Question 3: Explain the structure and function of an ecosystem, using a freshwater pond as an example. (20)**Answer:****1. Ecosystem Structure: Abiotic and Biotic Components**

An ecosystem is a dynamic functional unit consisting of living organisms interacting with their non-living physical environment. A freshwater pond serves as a classic self-sustaining aquatic ecosystem illustrating these complex interactions.

2. Abiotic Components of a Freshwater Pond

- **Physical Factors:** Solar light penetration, water temperature, thermal stratification, and turbidity.
- **Chemical Factors:** Dissolved oxygen (DO), pH levels, carbon dioxide, inorganic nutrients (Nitrates, Phosphates), and organic matter.
- **Zonation:** Littoral Zone (shallow edge with rooted plants), Limnetic Zone (open water light-penetrated area), Profundal Zone (deep dark water), and Benthic Zone (bottom sediment).

3. Biotic Components of a Freshwater Pond

- **Producers (Autotrophs):** Microscopic phytoplankton (algae, diatoms) and rooted/floating macrophytes (Hydrilla, Typha, Eichhornia) converting solar energy into organic matter via photosynthesis.
- **Primary Consumers (Herbivores):** Zooplankton (Daphnia, Cyclops), snails, aquatic insects, and tadpoles feeding on algae.
- **Secondary Consumers (Carnivores):** Small fish, water beetles, and frogs preying on primary consumers.
- **Tertiary Consumers (Top Carnivores):** Large predatory fish, water snakes, and herons/kingfishers.
- **Decomposers (Saprotrophs):** Benthic bacteria and fungi breaking down organic detritus, releasing trapped inorganic nutrients back into the pond system.

4. Functional Processes in a Pond Ecosystem

The functional dynamics involve unidirectional energy flow adhering to Lindeman's 10% Trophic Efficiency Rule, intricate food web networks, and biogeochemical cycling (Carbon, Nitrogen, Phosphorus cycles) maintaining pond ecological equilibrium.

Question 4: Discuss the factors influencing world climates and explain the Koppen climate classification system. (20)**Answer:****1. Primary Factors Influencing World Climates**

- **Latitude & Solar Radiation Angle:** Determines solar intensity; equatorial zones receive direct rays (high thermal energy) while polar regions receive oblique rays spread over larger surface areas.
- **Atmospheric Circulation & Winds:** circulation cells (Hadley, Ferrel, Polar cells) and trade winds/westerlies redistribute heat and moisture across latitudes.
- **Ocean Currents:** Warm currents (e.g., Gulf Stream) elevate coastal temperatures and rainfall, whereas cold currents (e.g., Benguela, Humboldt) create coastal arid conditions.
- **Continentality & Topography:** Landmasses heat and cool faster than oceans. Mountain ranges cause Orographic precipitation on windward slopes and rain-shadow deserts on leeward slopes.

2. The Koppen Climate Classification System

Developed by Wladimir Koppen in 1884 (and updated subsequently), this empirical system categorizes global climates based on monthly temperature means, precipitation distribution, and corresponding native vegetation zones.

3. Major Koppen Climate Groups

- **Group A: Tropical Climates:** High temperatures year-round (>18 deg C every month); sub-divided into Af (Rainforest), Am (Monsoon), and Aw (Savanna).
- **Group B: Dry/Arid Climates:** Evapotranspiration exceeds precipitation; sub-divided into BWh (Hot Desert), BWk (Cold Desert), BSh (Hot Steppe), and BSk (Cold Steppe).
- **Group C: Temperate Climates:** Coldest month between -3 deg C and 18 deg C; includes Cfa (Humid Subtropical), Cfb (Marine West Coast), and Csa (Mediterranean).
- **Group D: Continental Climates:** Cold winters (< -3 deg C) and warm summers; common in interior Northern Hemisphere landmasses.
- **Group E: Polar Climates:** Warmest month below 10 deg C; sub-divided into ET (Tundra) and EF (Ice Cap).
- **Group H: Highland Climates:** Undifferentiated mountain climates shaped by altitude lapse rates.

Question 5: Analyze the causes, types, and impacts of soil erosion in Pakistan. What measures can be taken to control erosion and conserve soil? (20)

Answer:

1. Causes of Soil Erosion in Pakistan

Soil erosion in Pakistan affects over 76% of the country's land area to varying degrees. Major drivers include rampant deforestation in northern catchment areas, overgrazing in Balochistan and Potohar, vertical cultivation on hilly slopes, and extreme precipitation events driven by climate change.

2. Main Types of Soil Erosion

- **Water Erosion:** Prevalent in northern mountain regions and Potohar Plateau. Sub-types include Sheet Erosion (thin topsoil removal), Rill Erosion (small micro-channels), Gully Erosion (deep ravines in Potohar), and Stream Bank Erosion.
- **Wind Erosion:** Dominant in hyper-arid zones such as Thar, Cholistan, Kharan, and Thal deserts, manifesting as saltation, suspension, and surface creep of sand dunes.

3. Environmental and Socio-Economic Impacts

- **Loss of Soil Fertility:** Depletion of topsoil organic matter, leading to sharp declines in agricultural productivity.
- **Siltation of Water Reservoirs:** Heavy sediment loads carried down the Indus River system reduce the storage capacity of Tarbela and Mangla dams, threatening hydropower generation and irrigation storage.
- **Infrastructure Damage & Landslides:** Gully erosion destroys highways, village structures, and agricultural terraces across AJK and KP.

4. Soil Conservation and Control Measures

- **Engineering/Mechanical Controls:** Bench terracing on mountain slopes, construction of stone check dams in gullies, and contour bunding.
- **Vegetative & Biological Measures:** Afforestation of bare hillsides, planting windbreaks/shelterbelts in desert margins, and sand dune stabilization using drought-resistant shrubs.
- **Agronomic Practices:** Adopting conservation tillage (no-till farming), crop rotation with legumes, strip cropping, and controlled rotational grazing.